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DISEASES of the CHEST

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A National Association of Chest Physicians

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Should remember several things about Tuberculosis.

FIRST:—

FATIGUE is the outstanding danger symptom. Ninety-five percent of cases will give this symptom in their history, generally extending over a period of months.

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DISEASES OF THE CHEST

(A MONTHLY PUBLICATION)

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"Application for entry as second-class matter is pending."

"The most important factor in diagnosis in the majority of cases of pulmonary tuberculosis is keeping the disease in mind."

Lawrason Brown, M. D.

Editorial Comment

Congratulations Associated Editors Of Tuberculosis Publications

THERE ARE approximately seventy five publications dealing with tuberculosis issued monthly by the tuberculosis sanatoria of this country. Some of these publications are mimeographed sheets while others are printed newspapers and many of them are in magazine form. The publications are edited by the patients of the sanatoria and in most cases are supervised by the medical directors or by some member of their staffs. A number of the state sanatoria receive appropriations to defray the cost of printing and editing their periodicals; but in most cases, the magazines or "San-Mags," as they are commonly referred to, are supported by the patients at the institutions through subscriptions and by the sale of advertising, principally that of the local merchants and friends of the institutions. Some of these publications have a circulation of several hundred copies monthly, while others circulate many thousands of copies each month. It is estimated that the combined circulation of these seventy five sanatoria publications reach more than one hundred thousand readers monthly.

For many years, these publications have offered to patients an outlet for expression and a means for occupational therapy; and each of the publications, in its own way, has conducted an educational campaign directed towards the prevention, early diagnosis, and the treatment of tuberculosis. That they have served and are serving a necessary and useful purpose is shown by their reader interest and their many years of useful activity.

In order that a number of their splendid ideas and activities might be coordinated into a program which would reach all of their readers, they decided that they would organize themselves into an association to be known as the "Associated Editors of Tuberculosis Publications" (AETP).

The Organization Committee is composed of the following editors of tuberculosis publications: Chairman, Murray Kornfeld, managing editor, "Diseases of the Chest"; Vice-Chairman, Carey Holbrook, editor, "Health City Sun," Albuquerque, New Mexico; Secretary-Treasurer, Mrs. W. M. Harman, editor, "The Buzzer," Essex Mountain Sanatorium, Verona, New Jersey. The other members of the committee are: Marie Bowie, editor, "SoCaSan Piper," State Sanatorium, South Carolina; Myrtle Rockwood, editor, "Grit-Grin," Perrysburg, New York; Lee Burton, editor, "The Stethescope," Oakdale, Iowa; and R. W. Henson, editor, "The Chaser," State Sanatorium, Texas.

One of the main objects of the association will be to work for the establish-

ment of a "Tuberculosis Week," which will be similar to other periods set aside by presidential decree, and at which time the public will be encouraged to visit their family physicians for chest examinations, x-rays, and tuberculin tests.

Diseases of the Chest heartily endorses the program and the purposes of the Associated Editors of Tuberculosis Publications. C. M. H.

Southwestern Medical Association THE CLINICAL Conference of the Southwestern Medical Association will be held November 19-20-21, 1936, at El Paso, Texas.

This is an intensive three day Post Graduate Course, which will be of interest to every physician in the far southwestern and southern Rocky Mountain regions.

Every speaker is a prominent teacher. The Program Committee has been very fortunate in securing these outstanding men who will provide the most instructive program possible.

The Officers of the Southwestern Medical Ass'n extend a cordial welcome to all physicians who may find it possible to attend. The program below speaks for itself.

General Medicine.

Dr. Ralph A. Kinsella, St. Louis, Missouri, Professor of Internal Medicine, St. Louis University School of Medicine.

General and Thoracic Surgery.

Dr. Harold Brunn, San Francisco, California, Professor of Surgery, University of California Medical School.

General and Traumatic Surgery.

Dr. Isidore Cohn, New Orleans, Louisiana, Professor of Clinical Surgery, Tulane University School of Medicine.

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Dr. Nelse F. Ockerblad, Kansas City, Missouri, Associate Professor of Clinical Surgery, University of Kansas School of Medicine.

Roentgenology.

Dr. James T. Case, Chicago, Illinois, Professor Radiology, Northwestern University School of Medicine.

Internal Medicine and Allergy.

Dr. Warren T. Vaughan, Richmond, Virginia, Editor of Journal of Laboratory and Clinical Medicine.

Otology, Laryngology, Rhinology.

Dr. Thomas E. Carmody, Denver, Colorado, Past President of the American Laryngological, Rhinological and Otological Society.

Obstetrics.

Dr. Willard R. Cooke, Galveston, Texas, Professor of Obstetrics and Gynecology, University of Texas School of Medicine.

C. M. H.

Statistical Survey DURING THE MONTH of November, the Statistical Committee of the Federation of American Sanatoria will mail questionnaires to every tuberculosis sanatorium in the United States. The object of this survey is first, to ascertain the facilities for post-graduate training in tuberculosis now existant, and, second, to acquire accurate information as to the number of beds now available and the number of beds needed for the care of the tuberculous.

The cooperation of the superintendents of each institution is requested by the committee. R. B. H.

Happy Birthday THE HEALTH CITY SUN of Albuquerque, New Mexico is to be congratulated upon having successfully completed seven years of service in the interests of the tuberculous of this country.

The Health City Sun is the only tuberculosis newspaper in the United States published as a weekly and its existance and editorial purpose is a fine tribute to its editor and owner, Carey Holbrook.

Mr. Holbrook is supporting for election in the State of New Mexico, two expatients, one a republican and the other a democrat. It will be interesting, in the event of their election, to watch their voting, particularly on legislation affecting the tuberculous of this country.

Diseases of the Chest wishes the Health City Sun many more happy birthdays.

M. K.

Tuberculosis in the Child: Its Relation to Tuberculosis in the Adult*

BY
CHARLES V. BARLEY, M.D., F.A.A.P.**
Tucson, Arizona

OUR PRESENT concept of the problem of tuberculosis in the child and its relation to tuberculosis in the adult has been developed as the result of enthusiastic efforts to study the disease and to observe the phenomena of its various stages throughout infancy and childhood, which has been, up to about fifteen years ago, a neglected age period. As statistical studies make it evident that the periods of adolescence and early adult life are charged with high morbidity and mortality rates from the adult form of pthisis, it becomes more apparent that something goes on in the period of infancy and childhood which has a bearing on the high incidence of clinical tuberculosis in these later age periods. The methods of clinical investigation suitable for demonstrating the disease in the adult were found to be of very little aid in bringing to light a picture of what was taking place during the pre-adolescent age period in those children who later develop the adult type of tuberculosis with cavity formation. With the hope that, by controlling the spread and progress of the disease during the period of infancy and childhood, we should be reaching the fountain-head of tuberculosis, careful studies were begun some 15 or more years ago. These studies, because they have permitted the close follow-up of thousands of cases from infancy and early childhood throughout a period of many years, have made it possible to observe the disease in its inception, through its various stages, and into the teen-age and early adult periods. The results of such studies have caused us to abandon some of the orthodox views, and each year is adding more to our conception of prognosis, the significance of findings, and the rationale of therapeutic procedures. It is my purpose merely to present the ideas which are recognized by most of the workers in this field, concerning the relationship between tuberculosis in the child and in the adult in such a way as to afford a practical working basis for the understanding and care of the child with a tuberculous infection. An attempt will be made to explain what we mean when we speak of the primary infection, or so-called "childhood tuberculosis," and in what ways it differs from the later reinfection type, or so-called "adult tuberculosis." It is acknowledged that there are many questions not yet completely solved which will be clarified by further studies over longer periods of time.

If one studies a graph representing deaths from tuberculosis plotted by ages, it is noted that there is a high peak in the second half of the first year of life, representing infant mortality, and that thereafter there is a rapid fall in the curve, which persists at a low level until the adolescent period is reached. It is thereby demonstrated that throughout this latter period the disease pursues a relatively benign course. With the onset of adolescence the curve rises sharply, that of girls, because of earlier maturity, rising earlier than in boys, and the great peak being reached between the ages of 20 and 30, after which there is a gradual decline throughout the later years of life, until the meridian of life is past, when it gradually rises again, being, according to statistics, highest in old age. The clinical course and anatomical features of the disease that produce this first peak, in infancy, are quite different from those that produce the later peak in the adult age period. We have known for some time, however, that the first or primary infection has essentially the same characteristics at whatever age it occurs.

This first infection tends to pursue a characteristic course. Although familiar

*Read at the Rocky Mountain Tuberculosis Conference, Albuquerque, N. M., September 29, 1936.
**From the Tucson Clinic.

to most of those present, the important stages in its development and progress may be cited as follows:

(1) Tubercle becilli enter the body, usually by way of the upper respiratory tract, and lodge in some part of the lung, as often at the base as at the apex. The liberation of tuberculin at this site produces a mononuclear cell pneumonia accompanied by tubercle formation.

(2) Tubercle bacilli are disseminated to the regional tracheobronchial lymph glands, through which barrier they may sometimes pass and, by way of the thoracic duct and general lymphatics, involve remote lymph glands. It is not yet known in detail, however, the extent to which the bacilli of first infection are distributed throughout the body.

This lymphadenitis of the regional tracheobronchial lymph glands and the primary focus in the lungs constitute what is known as the primary complex.

The clinical picture in the patient during this period is as follows: There is a period of three to six or eight weeks after tubercle bacilli gain entrance into the body, during which there are no symptoms at all, although there have been instances when organisms have been found in the gastric contents at this time. This is the pre-allergic period of the first infection. The allergic phase of the primary infection is ushered in by four outstanding clinical findings which occur at about the same time, although one may precede one of the others by a brief period.

(1) Fever.

(2) Cutaneous sensitivity to tuberculin.

(3) Increased sedimentation rate of the red blood cells.

(4) X-ray picture of a peri-focal pulmonary infiltration of greater or lesser extent which may or may not be accompanied by recognizable physical findings. The most striking feature is the large amount of involvement revealed by the x-ray as contrasted with the paucity of clinical symptoms.

This initial fever is usually transitory but the sedimentation rate remains increased even after the temperature drops. The pulmonary infiltrations, depending upon their density and extent, remain recognizable by x-ray for varying periods throughout several months, eventually undergoing resolution and terminating in the production of fibrotic or calcified scars.

It is seen, therefore, that after a transient, initial period of acute onset, which is frequently not recognized, the further course of the first infection is relatively benign and retrogressive, usually, without cavity formation and other destructive lesions. However, this benign course may be and is occasionally interrupted by the escape of bacilli beyond the confines of the local lesion in the lung or glands, with dissemination of tubercle bacilli by way of the blood stream to distant parts of the body, producing tuberculosis of such organs as the spleen, liver, and meninges, and in some instances generalized miliary tuberculosis ending in death. This is more apt to occur at an early period in the development of the disease, before a very high degree of specific immunity has developed to wall off the process, and accounts for the first peak in the mortality curve occurring in infancy. Although the probability of disseminated tuberculosis is related to the dosage of organisms which the victim takes into his body, evidence at present indicates that this is more often an accidental occurrence, rather than one dependent on the tissue defenses of the body. Infection, especially in the case of infants and young children, may also gain entrance by way of the gastrointestinal tract, and in these cases pursues a course analagous to that described above. By the employment of more accurate methods of examining for tubercle bacilli, and by searching stomach washings and stools in cases where satisfactory specimens of sputum cannot be obtained, we have learned that the escape of organisms from these primary foci occurs more commonly than was previously thought.

Tuberculosis of the reinfection or "adult" type presents features of a dif-

ferent character, beginning in the lungs and producing the following changes:

(1) It begins, usually, in the upper part of the upper lobes, often far removed and even in the opposite lung from the demonstrable primary focus, and tends to remain localized in the lung, most often in the upper parts.

(2) As compared to the first infection, the lymphatic structures and regional lymph glands show relatively slight involvement, and gross caseation of these structures, as often occurs in the primary infection, is relatively rare.

(3) Blood-stream dissemination and the production of miliary tuberculosis are uncommon, occuring usually as an accidental and late event.

(4) Progress of the disease, when it occurs, is usually by way of the bronchial tract to involve other parts of the lungs, and also the larynx and intestinal tract.

(5) The disease tends to pursue a chronic course, often attended by cavity formation, with healing by fibrosis.

The reinfection type of tuberculosis does not appear commonly until the approach of adolescence, and, then, as shown by the mortality curve, increases rapidly in frequency, paralleling the number of positive tuberculin reactors, just as the presence of a primary infection increases with advancing age. However, rarely, the infant may develop the reinfection type a relatively short time after the primary infection is produced, and this may go on to cavity formation and early death. Again, continued massive exposure outdistancing the rallying of immune defenses is probably a factor in the production of these cases of the reinfection type at an early age. It has never been conclusively demonstrated that there is a racial difference in reaction to the first infection, and the higher mortality figures for certain groups of Mexican, Indian, and Negro children is probably caused by environmental factors responsible for the early onset of the reinfection type, giving rise to this form of the disease prior to the period of adolescence.

Recent studies dispute the earlier belief that one who receives his first infection in adult life reacts less favorably to it than the child. Apparently, the human body can experience the benign primary form of the disease but once only. It has been shown by Myers and others that nurses from rural districts, who began training without any previous contact with tuberculous patients, and who showed, as a result of tuberculin test and x-ray, no evidence of ever having experienced a primary infection, when exposed to tuberculous patients in the wards, would always develop the first infection type of the disease, regardless of their ages. In these cases, the course of the first infection was almost identical with that occurring in the child. However, in those who began training with evidence of having had their first infection sometime during childhood, when tuberculosis did supervene in a small percentage of these, after variable periods of contact, it was always of the reinfection type.

The pathogenesis of the primary lesions, as I have described them, has been pretty well understood for over 15 years, and we are indebted especially to the investigative work of such men as Opie, McPhedran, Krause, and Chadwick for the demonstration and description of what takes place at this time, particularly from the anatomical standpoint. Within the past ten years there has developed an especial interest in the role of allergy in this connection and an attempt is being made to correlate previously unexplained phenomena with the factor of allergic sensitization of lung tissue following the primary infection. There will be no attempt made here to theorize on the relationship of immunity and allergy in tuberculosis. Such evidence as we have is in many respects contradictory, and there is still a wide lack of agreement among those who have made the subject a matter of especial study. Most of the experimental work has been done on animals and, while we have reason to believe that other mammals react to the first and reinfection types in the same manner as man, it is often difficult to

correlate the observations with the complex changes in human tuberculosis. We know that sensitization to tuberculin and increase in specific resistance are acquired at about the same time, with the onset of the primary infection. As a result of this tissue sensitization, there occurs an intensified reaction to the implantation of tubercle bacilli at a later date. Parallel with this the forces of immunity under favorable conditions hasten destruction of the organisms, check the progress of the lesions, and start healing. These two processes parallel each other, but the exact relationship between them is not clear. Moreover, as healing of the lesion of the first infection proceeds, sensitization to tuberculin diminishes and may disappear as does the factor of immunity.

I should like to emphasize at this point a very practical aspect of this question which concerns prognosis in the relationship between these two types of tuberculosis. Disregarding for the moment those cases in which acute disseminated tuberculosis follows shortly after the initial infection (and those cases are relatively few in comparison with those in which it does not), the question has been put in this manner: Does the primary infection constitute an asset or liability as far as its relation to the adult form in later life is concerned? There is abundance of proof that the allergic state set up in the tissues by this first infection is a distinct liability when these tissues are faced with reinfection at a later date. However, there is also good evidence that a relative degree of immunity is conferred by the first infection, and that, in case of reinfection at a later date, the lesions, rather than being of an acute rapidly progressing type, are in most cases of a localized chronic type, such as is characteristic of the adult form.

One attempt to answer this question has been made by Myers and Stewart of Minneapolis, who have had abundant material to make this study with at the Lymanhurst School for Tuberculous Children. They have made observations in thousands of children, including serial x-ray pictures of the chest made at frequent intervals and covering, in many cases, ten to fifteen years in the life of the child. These studies have afforded an opportunity to follow the sequence of events in a given case starting with the pre-allergic stage before there is a positive tuberculin reaction, throughout the exudative and proliferative stage of the first infection, through the stages of partial resolution, to the end results of healing and calcification in the involved areas. Many cases have been followed in this manner to the onset of the reinfection stage in the apical and sub-apical regions, with extensive involvement. As a result of their observations they conclude that a primary tuberculous infection (which produces tissue sensitization to tuberculin) does not confer significant protection, but alters the tissue resistance in such a way that, when a reinfection is experienced, instead of being able to repeat the benign primary form, the body is doomed to develop the adult form of consumption.

This is also important because the use of the BCG vaccine of Calmette, which has been popular in certain clinics on the Continent for many years, and which is being studied in this country, notably by such competent observers as Dr. William H. Park and his associates in New York City at the present time, rests on a belief exactly the reverse. As you know, BCG vaccine is an attenuated culture of live tubercle bacilli, which, under properly controlled conditions, is not expected to increase in virulence after being introduced into the body. Entirely disregarding for the moment the question of danger from virulence, (and that point is disputed by different observers), it is an established fact that it is a means of artificially producing the first infection, with the production of allergy to tuberculin. At a recent round table discussion conducted by the American Academy of Pediatrics, which brought together the leading investigators on this subject in this country, the opinions expressed on

the question of BCG vaccine are of interest. This group included a pathologist, a pediatrician, an immunologist, and an authority on public health and preventive medicine, all leaders in this country in their respective fields. The pathologist expressed himself as opposed to the use of a vaccine containing live organisms, but felt that a slight degree of immunity might with safety be conferred by dead organisms. The pediatrician did not consent to express an opinion. The authority on preventive medicine, who has made a particular study of the tuberculous problem, was definitely opposed to its use; and the immunologist suggested 25 to 40 years further observation before rendering a decision. The diversity of opinions is obvious; nevertheless, in spite of the fact that its users advocate its use only in selected groups and under certain specified conditions, it is apparent that there is one school, if we may call it that, represented by those who feel that a carefully controlled first infection is an asset, and that the protection so conferred outweighs in importance the dangers of an allergy to tuberculin so established. Then, there is another school which stresses the undesirability and danger of the allergy set up by the first infection and which tends to minimize the importance of the protective immunity produced. In the present state of our knowledge, BCG vaccine had better remain in the hands of special investigators until further study has determined its usefulness.

A careful consideration of our present knowledge of the relationship between tuberculosis in the child and in the adult points the way to the attitude with which treatment of the first infection should be approached. The uninfected child should be protected from an open case in the home, so far as it is economically possible. This is best done by removal of the open case to a sanatorium. Even if one were convinced that there is some protective merit in a first infection, the inability to control the dosage of bacilli and the course of the disease makes it extremely hazardous.

Wallgren of Sweden believes that rest during the acute stage of the primary infection may prevent tuberculous meningitis and miliary tuberculosis. He has recently reported a series of 166 autopsies in cases of tuberculous meningitis in which 82.6 per cent had very recent primary lesions. He also reports 60 cases of tuberculous meningitis in which the exact date of the first manifestations of the primary infection were known, and he found that in two-thirds of the cases the meningitis developed within the first two months after the onset of tuberculin allergy. He finds that the younger the child the greater the risk of meningitis, and he feels that sanatorium treatment is indicated, at least during the first three to six months after onset of the initial infection. By separating cases diagnosed at the onset of the infection from further contact, and following a specified rest regime during the first 3 to 6 months after the primary infection was first manifest, he has appreciably lowered his mortality figures from tuberculous meningitis. Other investigators are not convinced that treatment, other than breaking contact, has appreciable effect on the death rate from complications.

The great difficulty at this stage is, of course, that most of the cases are not seen or recognized at the time of onset of the first infection. But, in our present state of knowledge, cases seen at this stage should be:

(1) Removed from contact with an open case.

(2) Kept in bed as long as the fever persists and as long as the blood sedimentation rate is increased.

(3) Allowed gradually increasing exercise after symptoms have subsided until clinical and x-ray evidence of healing is satisfactory enough to enable him to pursue normal activity.

After the stage of acute clinical symptoms has passed and healing, as shown by calcification in the affected areas in the x-ray, has begun, experience has shown that throughout the remainder of child-

(Continued to page 30)

Tuberculosis in Adolescence*

BY
ARNOLD S. ANDERSON, M.D.
St. Petersburg, Florida

ADOLESCENCE is that period of youth from 12 to 25 years of age. It marks one of the most important stages stages of human life, a period of emotional development, sexual adjustment, physical and mental growth, and a period of unprotected exposure to the world dangers. During these formative years 20,000 youths die annually in the United States from tuberculosis.

The incidence of tuberculous infection and disease in adolescence has been widely studied during the last few years. Chadwick, in the Massachusetts school clinics, found that at 10 years of age 28 per cent were infected and at 15 years 35 per cent were infected. McCain in his school survey in North Carolina found 21 per cent infected and 1.6 per cent that had active tuberculosis. Rathbun in New York State found 1.5 per cent of his school students with active tuberculosis, and Opie and McPhedren of Pennsylvania found active disease in 1.6 per cent. It is interesting to note that the percentage of active tuberculosis present in the youths in these different parts of the country was practically the same.

In a survey of 65,000 school children in Minnesota, it was found that 12 per cent of the children in the 5 to 10 year group reacted positively, and 22 per cent of the 10 to 20 year group were positive. 0.2 per cent of the 5 to 10 year group had the adult type of tuberculosis while 0.4 per cent of the 10 to 20 year group had this type of disease.

In all tuberculin testing surveys conducted, one thing is common and that is that with increase in age comes a higher percentage of reactors. This corresponds to the increased number of contacts which come to the individual as he journeys through life. First we have the home. Should a positive sputum case exists there, it is as a fountain of water which gently sprays its immediate environment to the point of saturation. Frequently, 100 per cent of the children become infected. On the other hand, children from non-tuberculous families may have as low an incidence of positive reactions as 1 per cent. With this high incidence of reactors there also goes a corresponding increase in active tuberculosis and fatalities. Myers in his book, "Tuberculosis Among Children," mentions as a striking example a family of nine children all infected by a tuberculous mother and all dying from tuberculosis before passing the period of adolescence. Before we knew that tuberculosis was infectious, these sad instances were explained away on the basis of heredity. It is interesting to recall in this respect the words of Portal, Professor of Medicine in the College of France in the 18th century. His statement follows: "In the 'Journal of Paris,' it was reported in the year 1780, that a young man twenty years old had contracted phthisis by using the belongings and especially a fur coat of his father who had died of phthisis. Would it not be more natural, instead of this, to think that the child had inherited the disease from which his father had died, a disease which also had carried off four of his uncles and that he had died of hereditary phthisis? And yet this observation which furnishes so slight a proof that phthisis is contagious has been cited in favor of this opinion. One undoubtedly would reduce many observations of this kind to their proper value if one would subject them to a thoughtful and impartial investigation." Thus wrote a thoughtful and learned professor of medicine. Death spared him the fate of facing Villemen's and Koch's works which proved beyond the question of a doubt the contagiousness of tuberculosis.

As we proceed from the home to the school we find another not infrequent

*Presented at Annual Tuberculosis Conference, Tampa, March 30-31, 1936.

source of tuberculous infection. Jordon and Frost in their school surveys showed instances of tuberculosis spread from unsuspecting tuberculous teachers to non-tuberculous children. The spread of tuberculosis between room mates at school is not an uncommon happening. The problem of the spread of tuberculosis in schools has become such a vital one that many cities are making it compulsory to have all teachers and other employees in the public schools tuberculin tested and x-rayed for the protection of students.

As the adolescent arm reaches out to encircle more contacts we find two particularly fertile fields for the obtaining of a tuberculous infection; courtship and marriage is one, and the hospital is the other.

Every worker in tuberculosis can cite cases of one lover infecting the other with tubercle bacilli. There is perhaps no more ideal method for disseminating infection than here and the old saying that love is blind is not without great truth. We used to believe that marital tuberculosis was of no more frequent occurence than that found in the general population, but Opie cites the work on marital tuberculosis carried out at the "U" of Pennsylvania which shows that if one partner has active tuberculosis, the other will show x-ray evidence of disease in 50 per cent of the cases. This, of course, is a far greater incidence of disease than is found in the general population.

The role of the hospital as a breeding ground for tuberculosis has been forcibly brought to our attention by many investigators. The nurse and the medical student play the principle parts in this tragic drama. Heimback of Stockholm showed that 50 per cent of the probation nurses were positive to tuberculin, but that at the end of their nursing course 100 per cent were positive. Geer found that 30 per cent of the nurses entering training at the St. Paul City and County hospital reacted positively to tuberculin, but that at the end of 3 years 100 per cent of them were positive and 5.5 per cent of them showed evidence of adult type of tuberculosis. It is hardly necessary to state more statistics readily available, which verify the fact that hospitals are frequently as responsible for infecting a nurse as a tuberculous home is for infecting an innocent child.

At the University of Pennsylvania, Hetherington, McPhedran, Opie and Landis found an alarming increase of tuberculosis in medical students from year to year. Apical tuberculous infiltrations jumped from 4 per cent in the first year students to 20 per cent in the fourth year students. Similar results were found by Myers at the University of Minnesota. These investigations and many others have shown that the incidence of tuberculous infection and disease is much higher in the nursing and medical professions than in any of the other professions.

Why does tuberculosis claim such a large toll of life during the period of adolescence? It strikes youth a terrific blow, killing many more at that fruitful period of life than any other disease.

Some of the habits of adolescence such as diet, fads, and improper clothing, as well as the physiological changes that occur, have received blame. We do not know whether they are guilty or not. We do know, however, that the incidence of tuberculous infection is approximately twice as great during this period, as it is in the 5 to 10 year period. We also know that with an increase in infections comes increased disease. From this fact alone it is evident that we should find a mounting percentage of tuberculous disease in the teen age. Another important fact stands out and that is the type of exposure during adolescence which makes for repeated and prolonged exposures. They are schools, intimate social contacts, hospitals, and other gathering places that provide contacts of daily frequency. Large and repeated doses of tubercle bacilli implanted upon fertile and well oxygenated soil seems to lead to destructive disease. Why it should is still a matter of controversy. It is an interesting fact, however, that both can-

cer and tuberculosis once they gain a firm foothold in young individuals lead progressively and rapidly to destructive lesions. In old individuals, on the other hand, they both take on the characteristics of a slow and chronic disease.

If we add to the two above mentioned factors, that is, fresh infections and prolonged and frequent exposures, the strenuous life of adolescence we find what seems to be a logical cause of the high mortailty rate found in this age group.

The treatment of tuberculosis in the adolescent consists of:

1. Prevention.
2. Care of the Active Case.

The prevention of the disease consists of:

1. Improved general living conditions which permit less crowding and more wholesome environments. With decreased filth and poverty go decreased mortality rates from tuberculosis.

2. Early diagnosis, and the finding and removing of sources of tuberculous infection. Tuberculin testing surveys are a good start in this direction.

3. Sanatorium facilities for isolating positive sputum cases.

The treatment of destructive tuberculosis in the adolescent is essentially the same as that for any age group. The subject of collapse therapy, however, requires special mention. In view of the progressive nature of teen age tuberculosis, most authorities advocate the institution of pneumothorax treatments much earlier in adolescents than in older individuals.

The rapid spread of destructive tuberculosis in the adolescent chest demands local rest without much delay, and artificial pneumothorax provides this with the least amount of danger. If there is one thing to remember in the treatment of this type of disease, it is early active treatment as well as early diagnosis.

The tragedy of tuberculosis in youthful lives has been stamped upon every community. No city, county, state, or nation can say that this disease has never darkened its pathway, nor can any community say that by its good work it has under control the tuberculosis problem. There are those places, however, that by a proper apprehension of this devastating disease, have risen to the occasion and instituted recognized valuable measures to help stem its destructive force. Those places have learned that the beginning of tuberculous disease is tuberculous infection and that a program for the finding and removing of sources of infection is of paramount importance in helping helpless adolescence. Those places have also recognized that sanatorium facilities are an absolute necessity for obtaining any far reaching success in such work. They have provided for their communities places for isolating and treating the tuberculous. How much better this, than the closing of their eyes to an explosive consumptive cough and letting it gently spray their own sons and daughters.

If we seriously contemplate the control of tuberculosis in the adolescent and are really desirous of cutting down its terrific toll of life in the best years of youth, we must face unterrified this fact, it requires the expenditure of a considerable amount of money. There is no lazy way out. What is necessary is an outlay of cold cash, taxpayers money, to provide such institutions as are a safeguard not to our pocketbook, but to the health of youth.

As the campaign against tuberculosis continues, more and more stress will be placed on the great importance of the x-ray film in this work. There is no single measure that can approach its value in determining the presence or absence of destructive tuberculosis. At the present time, many hospitals take a routine chest film of every patient that enters the hospital regardless of the diagnosis. In this way, no nurse is subjected to the care of an unsuspected infectious tuberculous patient without knowledge of the nature of the case. As this practise grows, more protection against tuberculous disease will be given the nurse and more patients will be diagnosed early enough to give

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Some Aspects of Differential Diagnosis

BY
MARVIN S. HARRIS, M.D.
Los Angeles, California

MUCH has been written of failure in the early diagnosis of Pulmonary Tuberculosis, and the resultant defeat of therapeutic effort. On the other hand, little emphasis has been placed on the necessity of guarding, in our earnestness, against the too promiscuous diagnosis of the disease on the basis of signs and symptoms, often presumptive, but, as will be pointed out, not pathognomonic of tuberculosis.

Primarily, let it be said, the most important single factor in accurate diagnosis is an adequate history. It is the foundation on which the subsequent diagnostic structure rests, and no part of the latter can be stronger than its base. But once established, one must be content to regard it as a starting point, and not seek to take a diagnostic short-cut to a clinical conclusion on the basis of symptomatology, compatible with, but not pathognomonic of, tuberculosis. If the final diagnosis of tuberculosis in withheld until the structural lesion is demonstrated by radiographic or physical examination, or demonstration of the bacilli in the sputum, a much smaller number of patients will be unjustifiably diagnosed as tuberculous and a greater number of non-tuberculous conditions will be discovered at a time when therapy may be successful.

It is the purpose of this paper to review a number of chest conditions recently seen in hospital practise, illustrative of the necessity of establishing the diagnosis beyond reasonable doubt, and not depending on any single finding, or group of findings, conclusive though they may appear on cursory inspection of the clinical data. Limitation of space will not permit the use of case reports.

Tumors of the thoracic cavity, including bronchiogenic carcinoma, merit special attention. The recent advances in thoracic surgery and roentgen-therapy have greatly widened the possibilities of therapeutic success and have rendered the early recognition of these tumors a gratifying task. Considered as a group, they may become evident as mediastinal masses, areas of pulmonary opacities, atalectases due to obstructed bronchi, or as cavities due to the breaking down of the neoplastic mass. Any of these manifestations may be confused with pulmonary tuberculosis. The bronchogenic group may cause bleeding before any physical or radiographic evidence is available. No condition illustrates more aptly the advisability of caution in the diagnosis of tuberculosis in the absence of a demonstrable parenchymal lesion or in the face of a persistently negative sputum. Bronchoscopic examination is indispensable, and often clinches the diagnosis. At times, thoracoscopic aid is necessary. Occasionally, the laboratory may provide a hint in that the sedimentation rate is very rapid, while the Schilling count shows slight or no shift to the left.

Abscess of the lung, usually found in the lower portions, may also occur in the upper lobes, and particularly in the chronic state cannot readily be differentiated radiographically from tuberculous cavities. Usually, however, these patients give a history of onset with suppuration and sepsis, and the sputum is negative. Patients with chronic upper lobe abscess cavities present a particular problem, since they are frequently diagnosed as tuberculous, and receive treatment for tuberculous cavities. The acute inflammatory process at the onset, usually, has obliterated the pleural cavity, rendering attempts at pneumothorax unsuccessful, with the result that phrenic nerve operations are done, which fail to affect the abscess, but succeed in interfering with drainage of the secondary bronchiectasis, and in making the patient

more miserable. Careful and complete histories, difficult though they may be to obtain years after the onset, and assiduous search for tubercle bacilli, would obviate many such mistakes.

Aneurysm of the aorta, eroding into the trachea or the bronchi, is frequently the cause of hemoptysis, and if the aneurysm is small, more particularly if the eroded area is small, the fall in blood pressure following the bleeding may permit the formation of a clot. In such cases the bleeding may be oft-repeated, and the history extended over many years. It is rare that such aneurysms are not radiographically demonstrable. They may be suspected in the presence of hemoptyses, negative sputum, and positive Wasserman reaction.

Sufficiently often to deserve mention, the phthisiologist is confronted with a patient complaining of slight cough, vesperal fever, loss of weight and strength extending over a period of four to six weeks. Occasionally rales are heard in one or both infraclavicular regions. Radiographically, no parenchymal lesion is visible, and the sputum is negative for tubercle bacilli. A complete history may disclose an antecedent chancre; general examination discloses generalized shotty adenopathy, skin lesions are often absent when the general manifestations are severe, and the blood Wasserman is positive. Should the patient be put to bed for tuberculosis on the basis of the history and rales, without corroboration by x-ray and sputum, a brilliant cure of tuberculosis would be recorded and another potential neuro-syphilitic preserved.

Following hemoptysis, small amounts of blood dispersed throughout alveolar tissue may set up small patchy areas of pneumonitis, bearing a strong resemblance to tuberculous bronchopneumonia. Such lesions are seen in mitral stenosis, and various malignant and benign pulmonary and bronchial processes, and may lead to an erroneous diagnosis unless serial roentgenography reveals their rapid clearing within a few weeks.

Thickening of the interlobar septum, especially in children, often leads to wrongly diagnosed tuberculosis. It has been shown that this finding is practically as common in tuberculin negative children as in those with positive tuberculin reactions. The absence of other evidence of active pulmonary disease, the negative tuberculin reaction, the absence of tubercle bacilli from sputum and stomach washings should convince one of the non-specificity of the lesion.

Tuberculosis in childhood presents an acute problem. It must be remembered that the outstanding characteristic of the disease before the age of fifteen years is the almost complete lack of resemblance to clinical tuberculosis, as most of us know it. Local symptoms are rare and systemic symptoms are slight. A child who coughs more probably has asthma or bronchiectasis. It is not unusual to see children treated for years for active tuberculosis, when such treatment was without reason. In the light of present knowledge, the *sine qua non* in the diagnosis of childhood tuberculosis should be the positive Mantoux or the radiographic demonstration of the structural lesion or discovery of the tubercle bacilli in the sputum, stomach wash, stool, or exudate.

Space does not permit an exhaustive discussion of the conditions outlined above, or of the many miscellaneous conditions which, because of the emphasis placed upon certain symptoms, most notably hemoptysis, may lead to an erroneous diagnosis of tuberculosis. It is of interest, however, to add a number of conditions which in actual practise have led to erroneous diagnoses: bleeding from gums, pharyngeal varices, non-specific bronchial erosion, fatigue from neurotic states, fallen arches, coronary disease, cough from left ventricular failure, and post nasal drip.

It is obvious that errata of judgment and opinion will persist as long as diagnosis depends on the relationship of the many variable factors utilized in reaching a clinical conclusion. Perhaps, how-

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Differential Diagnosis of Pulmonary Tuberculosis From the Clinical Standpoint

BY
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IN THE TIME allotted to me for the presentation of the subject of Differential Diagnosis of Pulmonary Tuberculosis from a Clinical Standpoint, it is manifestly impossible to give all the distinguishing features about the diseases in question. In this paper I shall discuss the ulcerative types of tuberculosis in the adult and leave for another time the question of childhood tuberculosis and the pneumonic types, including acute miliary tuberculosis. It is presumed that all physicians know how to make a careful chest examination including the knowledge of the physical signs present in the normal right apex; for it is in this region that certain changes are elicited which lead many physicians to diagnose pulmonary tuberculosis when that disease is not present.

The diagnosis of pulmonary tuberculosis in the advanced stages of the disease would present no difficulties to any careful physician, but it is important to remember that many individuals who have signs and symptoms of advanced pulmonary disease are not suffering from tuberculous infection; therefore one of the very important steps is the proper examination of the sputum, which necessitates the examining of at least ten specimens of sputum within a period of three weeks and often it is necessary to have the sputum examined for organisms other than the tubercle bacillus. I recall a patient at Saranac Lake who was supposed to have had tubercle bacilli in his sputum, and who was examined at the laboratory of one of our metropolitan centers. The man died very suddenly and the post-mortem examination revealed a ruptured aortic aneurysm without any tuberculosis being present in the lungs. Another illustration of this point is a case of massive atelectasis seen at the White Haven Sanatorium. It was the case of a young woman who gave a history of illness since early childhood. The physical signs and x-ray evidences were of an advanced right sided lesion. However, the sputum was negative, and by further study we were able to conclude that this was not a case of tuberculosis but one of massive atelectasis. Many, if not most, of the cases diagnosed in sanatoria and elsewhere as far advanced pulmonary tuberculosis, with negative sputum for tubercle bacilli, are diseases of another causation.

Most physicians regard the importance of hemorrhage and pleural effusion without obvious cause as being great factors in the diagnosis of minimal pulmonary tuberculosis. Likewise, a previous history of several attacks of so-called typhoid fever and malarial fever are quite presumptive evidences of pulmonary tuberculosis. However, in the diseases which will later be discussed one will find that hemorrhage, pleural effusion, and fever are frequent symptoms.

There are several general factors which must always be given great consideration in arriving at a differential diagnosis. The first of these is that in pulmonary tuberculosis the disease is usually found in the upper half of the chest, although cases of basal tuberculosis have been definitely observed; in such cases tubercle bacilli should be discovered in the sputum before the diagnosis is warranted. A few months ago while on service at the White Haven Sanatorium I had four cases of basal tuberculosis, all of whom had tubercle bacilli in the sputum. Physical signs were limited to the bases and we also received negative x-ray reports of disease in the upper half of the chest. All diseases located in the lower half of the chest are to be considered as non-tuberculous until

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definitely proven otherwise. Another almost invariable law is that when you have advanced tuberculosis in one lung there is practically always some evidence of disease in the contralateral lung. I do not wish to give the impression that tuberculosis is not to be diagnosed unless tubercle bacilli are found in the sputum, for it is very obvious that the case with the favorable prognosis will generally be found in those who do not show tubercle bacilli in the sputum. Since the advent of lung collapse therapy, it is to be noted that more and more of the sputum positive cases are amenable to arrest.

At this time, a few words may be said in regard to the method of making a chest examination and I have found it advisable to employ auscultation first and percussion last as contrasted with the commonly accepted methods of procedure. Also, it is important to remember that no chest examination is complete unless the physician has properly used auscultation with cough to bring out rales. In eliciting physical signs it is best to begin at the base, comparing from side to side first and then from base to apex on either side.

In this modern day, no one questions the efficacy of proper x-ray examination, tuberculin testing, and all other procedures which may be necessary to complete diagnosis. X-ray examination is of the greatest of value in deciding the diagnosis of a lung condition, but there are limitations to the interpretation of shadows as seen in chest films. I doubt the ability of the roentgenologist to decide clinical activity by the appearance of a film. Recently I had the experience of receiving two reports from two competent roentgenologists on the same film of the chest of a patient. One roentgenologist diagnosed strands while his colleague reported that no strands were present, but that a nodule was to be seen. While I depend upon the x-ray to a large extent in the differential diagnosis of chest conditions, I think that the clinician should have both feet on the ground and should interpret the x-ray findings according to the clinical condition as it presents itself.

With this preliminary report I shall give some of the distinguishing features of the diseases with which tuberculosis is quite often confounded. Many of the diseases which will be later enumerated can be better differentiated between if the proper interpretation of the x-ray film is made and a study of the sputum for organisms other than tuberculosis is completed.

Upper Respiratory Diseases. Frequently diseases of the tonsils, pharynx, and nasal sinuses resemble pulmonary tuberculosis. Many such cases are to be found in most tuberculosis sanatoria. As a rule, the cough is of years duration, more marked in the recumbent posture, and a large part of the sputum is brought up by hacking or postnasal dripping. Associated with this is nasal obstruction and a certain amount of toxemia as evidenced by temperature and increased pulse rate. In sinusitis, localized tenderness is at times elicited. Frequently, these upper respiratory diseases are associated with lesions in the bases of the lung and are never to be diagnosed positive for tuberculosis without the finding of tubercle bacilli in the sputum.

Cardiac Diseases. The chief cardiac disease with which tuberculosis is often confounded is mitral stenosis and it is not infrequently observed that a patient with this disease is sent to a sanatorium. The characteristic murmur and thrill associated with enlargement of the heart should serve to identify such cases. In the cardiac diseases, dyspnoea is often a prominent symptom. Another frequent symptom is blood spitting or hemorrhage which may be present after endocarditis, pericarditis, or infarction. An example of the occurence of cardiac disease and tuberculosis in the same patient was afforded by a rather recent study of an individual at the Abington Hospital. The clinician had made the diagnosis of mitral stenosis and tubercle bacilli had been found in the sputum. Upon physical sign and x-ray examination, definite lesions

in the upper lobes of the lungs were clearly defined.

Chronic Bronchitis. The factors which distinguish this condition from pulmonary tuberculosis are that the cough and expectoration have lasted for years with the maintainance of the general good health. These symptoms frequently develop after an attack of influenza or occur in individuals who are particularly susceptible to colds. The finding of whistling rales, either general or at the bases, should arouse suspicion that the condition is one other than pulmonary tuberculosis.

Bronchiectasis. About two to five per cent of the patients sent to most tuberculosis sanatoria are not victims of tuberculosis but are individuals suffering from bronchiectasis. The distinguishing symptoms of this condition are the prolonged cough and profuse expectoration which is often influenced by posture. High blood pressure is frequently found and blood spitting is quite often observed. On physical examination the signs are usually found in the bases and bilaterally, but when unilateral they are more commonly found on the left. Study of the expectoration is negative for tubercle bacilli and another cause for the symptoms should be sought. X-ray, especially if lipiodol is instilled into the bronchi is of great value in making the differential diagnosis. Proper bronchoscopic examination will likewise prove of great value in differentiating this condition. Upper lobe bronchiectasis occurs occasionally.

New Growths. This includes a study of not only benign and malignant tumors of the bronchi, alveoli, and pleura, but also mediastinal tumors, aortic aneurysma, and Hodgkins disease. It is a characteristic of malignant disease of the bronchi that it often runs a benign course. The distinguishing symptoms are chest pain, dyspnoea, cough, expectoration, hemoptysis, and cachexia. In the more advanced stages the veins of the chest are enlarged from pressure upon the superior vena cava; also at times dilation of one pupil from pressure on the sympathetic nerve may be observed. Pleural effusion is at times bloody and the expectorated blood of these cases at times resembles currant jelly. In cases where the sputum is negative for tubercle bacilli and the trachea is found pushed to the opposite side one should be suspicious of a new growth, especially if it occurs in a person over forty years of age. Another physical sign in the distinguishing of these diseases is that the dullness in new growth is more marked than one usually observes in tuberculosis. This condition should also be suspected when it is known that malignant disease exists elsewhere in the body and metastasis to the glands has been found.

Hyperthyroidism. In exopthalmic goiter there is rarely any difficulty in distinguishing the condition from tuberculosis, but I recall a patient at the Kensington Dispensary for Tuberculosis on whom a diagnosis largely based upon the presence of cough, loss of weight, and rapid pulse was made. The clinician had overlooked the exopthalmus, the tremor, and a slight enlargement of the thyroid. This patient was treated with surgery and the subsequent tests during the last four years have proven negative for tuberculosis. In mild cases of hyperthyroidism the mistake is frequently made of treating such patients as having only tuberculosis, although the two conditions may be found in the same patient.

Chronic Pneumonia. A number of such patients are sent to sanatoria as cases of tuberculosis, but the negative sputum should always arouse a suspicion that the disease is one other than a Koch infection. Examination of the sputum reveals streptococci, diplococci, and pneumococci. A differentiating physical sign is that the disease is usually present in a lower lobe with the apices clear.

Interlobar Empyema. This condition should offer little or no difficulty as it often follows after pneumonia or an operation. The patient brings up large quantities of purulent sputum which is negative for tubercle bacilli and the dullness is usually elicited in the region of the interlobar fissure.

Pulmonary Abscess. This condition is usually preceded by an aspiration pneumonia, which occurs frequently after tonsillectomy, or as a septic pulmonary embolism after surgical intervention. In such cases the chief symptom is the expectoration of large quantities of sputum which is negative for tubercle bacilli. Quite often blood spitting or hemorrhage are symptoms and lead to the erroneous diagnosis. When the sputum is fetid, it makes the diagnosis of abscess even more reasonable.

Pulmonary Syphilis. Pathologically this is an extremely rare condition, but in any case having pulmonary symptoms, a persistently negative sputum for tuberculosis, and a positive serological test for syphilis, this disease should be suspected. There is usually a slight disability and the course of the illness is slow. Dyspnoea of a slight degree is frequently present. One only has to observe a number of positive Wassermann cases receiving the therapeutic test with the subsequent clearing up of the pulmonary symptoms to be convinced that syphilis of the bronchi and lungs must actually exist.

Foreign Bodies. Frequently, the history obtained shows that the individual has aspirated a foreign body. The physical signs are located at the base of the lung and the diagnosis is usually made certain by x-ray evidence.

Spontaneous Pneumothorax. Not many years ago, practically all cases of this condition were considered as being due to tuberculosis, but we have since learned that many such cases, without a previous history of tuberculous infection, occur when there is no evidence of infection with Koch Bacillus.

Pneumoconiosis. For this condition a history of the occupation is most important in making the diagnosis. Given an individual working in a dusty trade and presenting symptoms of cough, expectoration, and shortness of breath, one must always suspect this condition when the sputum is negative. Frequently, at a later stage, many of these dust infections are followed by definite pulmonary tuberculosis. It is to be born in mind that silicosis develops in those exposed to dust containing silica. Siderosis occurs in those exposed to iron-oxide. Anthracosis presents itself in those working in an atmosphere of coal dust while asbestosis occurs in those working with asbestos. In the White Haven Sanatorium we are able to observe at any one time about fifty cases of either pure anthracosis, or the combination of this disease with tuberculosis. A roentgenologist, who does not know the history of the occupation of the patient, will frequently make a diagnosis of miliary tuberculosis in these cases.

Actinomycosis. Sputum being negative for tubercle bacilli, other diseases must be eliminated by sputum studies. The differentiating feature of this disease is that microscopically small sulphur granules may be found in the sputum, while the fungus is revealed by microscopical examination. At times, local abscesses appear which may lead to a diagnosis of empyema. Physical signs reveal lesions in the lower half of the chest and the history indicates that the individuals have worked in contact with either straw or grain.

Pulmonary Blastomycosis. This disease is rarely seen in this community, most of the cases in this country having been observed in and around Chicago. Often there are accompanying skin lesions and the careful examination of the sputum will reveal the organism.

Streptotricosis. Many sanatoria at times admit these cases as ones of tuberculosis because slight hemoptysis is common. The other distinguishing symptom is that dyspnoea is frequently present. The general condition of the patient is apparently good and there is an absence of toxemia. An example of this condition is shown in the case of a young man who had been treated for tuberculosis in a sanatorium because of blood spitting. He reported at the Kensington Dispensary for Tuberculosis, where the sputum was negative for tubercle bacilli, and we were encouraged to study the sputum for other organisms; we found the sputum loaded with the streptothrix organisms.

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Aspergillus Fumigatus. This disease likewise simulates tuberculosis and is often detected when the sputum is examined for organisms other than tuberculosis. The history of occupation is of great importance, as most of these patients have been handlers of flour, meal, or grain.

Psittacosis. This is another of the infections discovered through study of the sputum. The distinguishing feature of the disease is that the individuals have been handling parrots infected with the organism. Another factor is that quite often several members of the family are infected at the same time.

Broncho-pulmonary Spirochetosis. This condition is often known as Castellani's disease, and in the study of the sputum for organisms other than tuberculosis, the spirochets are found in large numbers. The characteristic symptoms of this disease are a high, continuous fever associated with marked cough; expectoration of fetid sputum; and chest pain.

Conclusions. 1. Sputum is not to be considered negative for tubercle bacilli until ten specimens have been examined and then though should be given to other organisms as the cause of the disease under study.

2. Physical signs of advanced and extensive lesions in the chest with negative sputum are usually due to other conditions than tuberculosis.

3. X-ray evidence of extensive disease in only one lung with negative sputum should arouse suspicion of some cause other than tuberculosis as being responsible for the patient's illness.

4. Physical signs limited to the lower half of the chest should be considered as non-tuberculous until tubercle bacilli are found.

5. Careful attention to family history, occupation of the individual, history of previous illnesses, and present illness will often point the way to the correct diagnosis.

6. It is not necessary to find tubercle bacilli in the sputum to make a diagnosis of tuberculosis, but other diseases should be excluded.

7. Physical signs elicited above the third rib and the fifth dorsal vertebral spines, when crackling rales are obtained, should always be considered as tuberculous until definitely proven otherwise.

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FOSTER MURRAY, M.D.**
Brooklyn, N. Y.

IN THE BATTLE, in which we are all so vastly interested, against the disease, Pulmonary Tuberculosis — a disease known for centuries as the Great White Plague—we have come to hear more and more in recent years of new or modern weapons employed with increasing degree of success. How successfully they have been employed may be judged from the fact that the death rate from this disease has been cut to about one-quarter of what it was in the first year of the present century. This tremendous reduction in the death rate has truly not been just accidental, nor due to some occult or mysterious force; but may be safely ascribed in large part to the steady development and practicable utilization of a number of discoveries during the course of these and many preceding years.

Not all of the so-called Modern Weapons which we have learned to apply with such success are necessarily of recent discovery or invention. Some of them have been in use for many years but it is in their present-day application that they have become of incalculable value to the campaign. For it must be remembered that that part of the campaign which deals with the earliest possible discovery of the disease in man is just as vital to our warfare as the application of the many newer methods of treating the disease after the diagnosis has been made.

With this in mind let us consider the role of the microscope. Here is an instrument invented in the year 1590 by Zacharias Jensens of Holland which opened up vast new worlds for exploration and study. Without it, of course, accurate diagnosis would be impossible and without diagnosis the campaign against tuberculosis would be as a ship without rudder or compass. It was not until years later though, in 1882, when Dr. Koch of Germany by means of this instrument and by perfecting methods of staining bacteria first discovered the specific cause of Tuberculosis—the Tubercle Bacillus. With this discovery then, combining the use of the microscope and the means of differentiating bacteria by methods of cultivation and staining, we were given our first big formidable weapon—permitting us actually to identify the specific germ of the disease.

Again, it was in the year 1890 that this same Dr. Koch perfected his preparation of Tuberculin—which is now increasingly employed to detect the earliest presence of Tuberculosis infection. This important step is accomplished by means of injecting a small fraction of a cubic centimeter of the preparation into the skin. If the slightest degree of infection has already taken place, there occurs surrounding the site of injection into the skin, within forty-eight hours, a limited area of inflammation shown by a slight degree of redness and hardening. This is what is now known as the Mantoux Test—of paramount importance in revealing Tuberculous infection in children. Thus a discovery of some forty-six years ago has acquired immense prestige in our present-day campaign on the White Plague front.

Back in the year 1895, after years of experimental work, Professor Roentgen of Germany, introduced to an amazed world his extraordinary discovery of the x-ray. Here was an instrument by which the body was compelled to yield many of its inner secrets to the scrutiny of investigating eyes. Little time was lost in making useful application of this discovery to a study of diseases of the chest and what with the many technical improvements that have been perfected, it

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**Director, Tuberculosis Division, Kingston Avenue Hospital, Department of Hospitals, City of New York.

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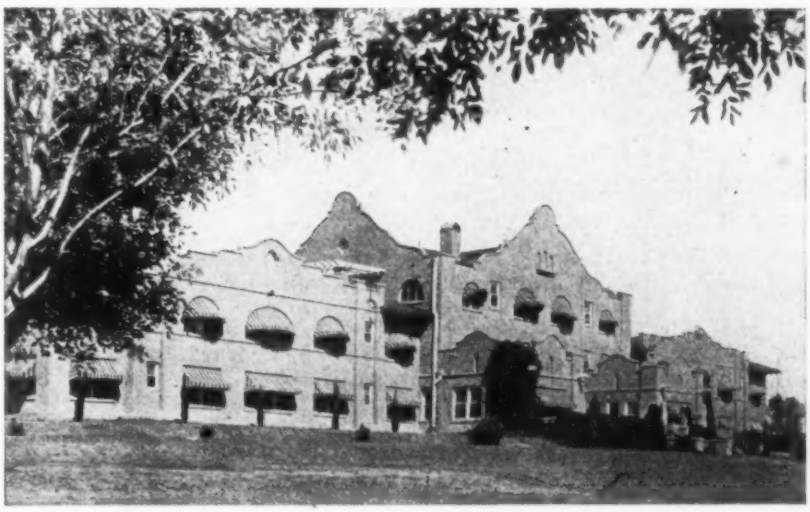

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has become, indeed, one of the Big Berthas in our warfare on Tuberculosis. Great as is its aid in diagnosing the earliest occurrence of tuberculous infiltration into the lung tissue, it is of possibly even greater assistance to the physician in helping him to evaluate the progress of the case; for by means of serial pictures taken at varying intervals he is able graphically to visualize the extent of the lesion, the character of it, the relative acuteness or chronicity of it, the destructiveness of it, and, what is most important, its general trend—whether it is progressing or retrogressing—getting better or getting worse. By it he learns quite accurately whether or not he is dealing with cavities —a vitally necessary bit of information because on such information he is most likely to base his decision on whether or not to employ collapse therapy. Also when collapse therapy is employed, by the x-ray picture or by the fluoroscope, he is able precisely to determine the degree of compression of the lung; the number, the distribution, and the character of the individual adhesions present, if any; the changes in size of cavities and the amount and distribution of fluid—when present in the pleural cavity. Hence, we see that a discovery of some forty-two years ago has brought to us a most precious instrument, of incalculable aid not only in diagnosis, but also in prognosing and in guiding the physician during the long course of treatment. So much for the weapons employed in aiding the diagnosis of Tuberculosis.

Let us now consider the big weapons that are chiefly used in the actual treatment of the disease. Rest is the basic idea underlying all such treatment. Hence, that oldest of all institutions in the world —the bed—achieves a most prominent place in our present-day armamentarium. Bed rest or horizontalization is utilized either alone or in combination with more radical measures. It has taken us all these centuries to grasp the primal importance of rest in combatting this disease, but there it stands today the preeminent weapon of defense. The majority of cases without cavity formation progress to eventual cure by utilizing this measure alone. The majority of cases with cavity formation require, in addition to general rest afforded by the bed, compression of the lung to insure complete obliteration of the cavity—for without obliteration of the cavity permanent cure can rarely be obtained. Thus, there has come into practice the various so-called operative methods of artificially collapsing or compressing the lung.

Of the operative measures employed to bring about collapse of the lung, the one most generally and usually first sought is that known as Artificial Pneumothorax—or the introduction of sterile air into the pleural space between the lung and the chest wall. The idea of collapsing a tuberculous lung by letting air into the chest was first conceived in the year 1822 by Dr. James Carson of England. The idea was not well received, however, and fell into complete disuse until the year 1894 when Dr. Forlanini of Italy and, quite independently, Dr. John B. Murphy of Chicago, resurrected it and by determined advocacy started it firmly on its way to universal recognition. Even at that, it has taken this measure almost forty years of slow development to achieve its present popularity.

Artificial Pneumothorax is a comparatively simple procedure performed by introducing a small hollow needle, under novocain control, through the soft parts between the ribs into the space between the two layers of the pleura. As the air flows into the pleural space, the lung is separated from the chest wall and gradually made to contract down or collapse. The air thus introduced acts as a splint to the lung—preventing motion, and if put in under sufficient pressure actually compresses it so that even large cavities are progressively reduced in size and eventually obliterated.

Artificial Pneumothorax is employed in cases where one lung is fairly extensively involved with actual destruction of tissue or cavity formation and in which

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the opposite lung is considerably less involved, and that preferably in an inactive state. It may also be used on both sides provided the diseased portions are not too extensive in either lung—a procedure known as bi-lateral pneumothorax. It is moreover employed to check profuse hemorrhage. The air introduced into the pleural space does not remain there permanently but becomes more or less rapidly absorbed. This necessitates repeated applications of the treatment at varying intervals until the time is deemed wise to discontinue the procedure—a matter of from two to five years depending on the extent of the disease process and the site and character of the cavities when treatment was first instituted; also, on the general condition of the patient, and on the persistent absence of tubercle bacilli from the sputum. In ideal cases, by stopping the treatments, the lung or lungs then gradually re-expand to approximately their former size, the original damaged areas contracted down and completely filled in with tough scar tissue, the rest of the lung slightly enlarging to fill the required space.

In those cases where Pneumothorax has been attempted and failed of attainment, some other method of achieving rest to the lung must be considered. The simplest of these consists of removing the phrenic nerve on the diseased side, which results in paralyzing the diaphragm of that side and causing it to rise in varying degrees up into the chest cavity. The paralysis of the diaphragm decreases the amount of motion to which the lung is subjected. The rise of the diaphragm lessens considerably the space within which the lung is housed, thereby causing that lung to be compressed by just that degree. Thus the loss of motion and the compression visited upon the lung serve to splint that organ and to promote the mechanism of healing. It is used also in conjunction with Pneumothorax, either on the same side or on the opposite, and sometimes used when Pneumothorax is about to be discontinued. The operation is performed through a small incision above the collar-bone under local novocain anaesthesia. To attain these same objects for only a temporary period, the nerve is crushed. This procedure while it has been found to be helpful in a number of cases, does not warrant universal application. It was first performed about the year 1910.

When for varying reasons none of these procedures can be successfully carried out, the more radical operations of thoracoplasty (rib operation) and apicolysis may be advised, provided the patient's general condition will permit. Thoracoplasty is usually performed in several stages and consists of removing a large portion of the ribs overlying the diseased tissues, thereby permitting the soft parts of the chest wall to cave in and so mechanically compress and relax the underlying lung. This compression of the lung becomes a permanent one and rest is thus continuously assured to the diseased part. It was first devised and performed by de Cerenville in 1885. The operation Apicolysis is used to compress large cavities located in the upper portions of the lung. Here, some foreign material—such as paraffin, gauze, transplanted fat or muscle is introduced between the lung and the chest wall.

And so it has therefore come about that the microscope, the specialized methods of staining bacteria, the use of tuberculin as a diagnostic agent, the x-ray, the bed, Artificial Pneumothorax, the Phrenic Nerve Operation and the Thoracoplastic Operations constitute the chief of the Modern Weapons. Many of these are, indeed, old in origin but in their present-day application have become truly modern. It is most significant and it must be remembered that they have come down to us out of an endless host of so-called cures and remedies, the most reliable measures to have survived the test of time. They represent to-day, the most efficient means we possess toward eradicating the Great White Plague.

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TUBERCULOSIS IN THE CHILD: ITS RELATION TO TUBERCULOSIS IN THE ADULT—(Cont. from p. 11).

hood the course of the disease is little influenced by treatment. As these foci, even in advanced stages of healing, still harbor live organisms, the child should be under observation and an annual clinical examination and x-ray of the chest made. Sanatorium treatment is not indicated at this stage and the expense of maintaining preventoria is not justified in many cases except that the contact with the open case is broken for the relatively short period that the child is under preventorium care. Where home conditions are very bad the child is benefited in a general way by the improved hygienic regimen which he finds in the institution. In most cases he would benefit in a larger sense by removal of the open case to a sanatorium, permitting the child to have a normal home and family environment. The child who is put back into the same home environment, after a short period like 6 months in an institution, rapidly loses the benefits of the preventorium regimen, and is again faced with exposure to reinfection if the home conditions have remained unaltered. Where he can be placed in a preventorium to tide over the period during which disposition of the open case and improvement in home conditions is under way, the benefits are more permanent. Other than that, the treatment at this stage consists of a good general hygienic regimen.

The question arises as to whether the child with a primary infection is a practical source of danger to negative reactors, or those who have never experienced a primary infection. Although at times the bacilli can be obtained from stomach washings or sputum, it is unlikely that the actual spread of disease from these cases is of much importance. Even if it were considered ideal to separate these cases it would be practically unfeasible.

In families where there is an open case, all members should be given a tuberculin if at any time they become positive reactors. It should also be remembered that test. Those who react positively should have a clinical examination and chest x-ray made, and this should be repeated annually. Those who do not react positively do not require an x-ray, but should be retested once a year and x-rays taken the gastrointestinal tract may be the portal of entry, and in cases with a positive tuberculin reaction and no demonstrable foci in the chest x-ray, pictures should be taken of the cervical and abdominal regions, which may disclose calcified glands. Also, chest pictures taken in antero-posterior, lateral, and oblique positions are of more value than stereos in the case of children's chests, as they afford a better view of the hilar region where calcification is most often sought.

Out attention should be directed especially to watching for changes occurring in the teen ages. After the age of ten, the child with a primary infection should be kept under stricter observation, and physical examination and x-rays made oftener than once a year in suspicious cases.

In closing, then, it may be said, that we have, at the moment, enough definite knowledge about the etiology and pathogenesis of tuberculosis in the child, and its relation to tuberculosis in the adult, to form a sound basis for diagnostic criteria and therapeutic procedure. It is extremely important to keep abreast of these changing viewpoints because they influence our concept of all phases of tuberculosis. The continuation and completion of other studies, now under way, will tend to clarify many points and fill in gaps that now interfere with a completely rounded-out picture of this relationship.

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TUBERCULOSIS IN ADOLESCENCE—(Continued fro n page 14).

them a more certain recovery. If society would only regard the routine chest x-ray of every individual from twelve years up as important as the fingerprinting of criminals then we would be a long ways on the road to the control of tuberculosis.

———(o)———

SOME ASPECTS OF DIFFERENTIAL DIAGNOSIS—(Continued from page 16).

ever, we are too self-indulgent in seeking refuge behind this hackneyed sentiment to explain failure occasioned by not putting to use the facilities at our command. Despite the cries against the mechanization of medicine, there is little of personal error in a diagnosis confirmed by radiographic demonstration of cavity, and microscopic demonstration of tubercle bacilli.

———(o)———

ABSTRACT

G. RICHARD, The Syndrome of Exophthalmic Goiter and Tuberculosis. Rev. franc. d'endocrinol. 12:199, 1934.

Richard brings together in this article the results of observations of various investigators and of his own which seem to indicate the existence of an interplay between activity of the thyroid gland and the course of a tuberculous process. He recalls that Morin, in 1885, noticed improvement in 87 per cent of 348 tuberculous patients who had normal or hypertrophied thyroid glands, while in another group of patients with atrophied glands improvement occurred in 37.8 per cent. A similar correlation was established experimentally in laboratory animals by Charrin in 1898, Frugoni and Grisconi in 1909, Uhlmann in 1911 and Solis-Cohen in 1911. Couland expressed the only dissenting opinion when he claimed that destruction of the thyroid gland in rabbits does not render the animals more susceptible to infection and that histologically the thyroid gland in tuberculous animals has a normal appearance. Richard refers to his own observation, made in 1907, regarding the relatively frequent coexistence of exophthalmic goiter and of incontestable manifestations of tuberculosis, and the usual benign character of the tuberculous process in such combinations. He was also impressed at that time with the rather mild nature of exophthalmic goiter in persons suffering from tuberculosis. He mentions also his observations of a dozen patients who showed a spontaneous tendency to recover from a tuberculous process after the syndrome of exophthalmic goiter became manifest. Similar observations were made by Lereboullet and Sabourin. Richard mentions finally the fact that the close relationship between hyperthyreosis and tuberculosis was sustained at the National Medical Congress held in Paris in 1934, thus affirming a view advanced thirty years ago by Morin and shortly afterward by Richard himself.

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